ELEC 242 - Spring 2015

Organizational Information

1. *Class website*: `https://owlspace-ccm.rice.edu/portal/site/ELEC-242-001-Sp15`

2. *Review Sessions*: The TA for this class, Chris Metzler (strikemetz@gmail.com), will conduct a review session every Tuesday at 6:30pm in DCH 1064.

3. *Homeworks and tests*. There will be 3 tests and 10 homework assignments, in total. There will be a penalty of 50% for assignments submitted after the deadline and before the solutions are handed out. The three tests will take place at 7pm, on the dates shown below, and will last for 2 hours:

HWs	01/21		
	01/28	02/25	04/01
	02/04	03/11	04/08
	02/11	03/18	04/15
Tests	18 Feb	25 Mar	22 Apr

4. *Grade*. The final grade will be based on the HWs (16%) and the tests (28%) each.

5. *Reading material*: there is no required textbook for this class.

6. *Office Hours*: MWF 1:30pm - 2:30pm, or by appointment.

7. Any student with a documented disability needing academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All discussions will remain confidential. Students with disabilities should also contact Disabled Student Services in the Ley Student Center.

   Any student with a disability requiring accommodations in this course is encouraged to contact me after class or during office hours. Additionally, students should contact Disabled Student Services in the Ley Student Center.

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ELEC 242 - Spring 2015: Course contents

- (1 week) Resistive circuits with dependent sources: writing equation and solving for currents/voltages. Dynamic circuits involving storage elements (inductors, capacitors).

- (1 week) Introduction to transform methods and the frequency domain. The Fourier and Laplace transforms. Differences, similarities, properties and when each should be used.
- (5 weeks) Setting up differential equations for linear circuits and solving them by means of the *frequency domain*.
  - The role of initial conditions (initial charges of the storage elements).
  - The concepts of complex frequency, the transfer function and the impulse response. The inverse Laplace transform and partial fraction expansion.
  - The numerator/denominator polynomials of the transfer function and the associated differential equation. The notation: $d(s)Y(s) = p(s)V(s)$, where $v(t)$ is the input (excitation) signal and $y(t)$ the output (observation) signal.
  - Transient/steady state and zero-input/zero-state parts of the solution.
  - Expressing the behavior of a circuit in the frequency domain in terms of sets of coupled equations which are rational in the complex frequency. The use of `MatLab` is solving these sets of coupled equations.
  - The location of the poles of the circuit in the complex plane and circuit behavior:
    stable/unstable; relation between controlled sources and instability/oscillations.
    underdamped, critically damped, overdamped, and oscillatory.
  - The frequency response and the Bode amplitude and phase plots.
- (3 weeks) Solution of linear differential equations in the *time-domain*.
  - Convolution of continuous-time signals.
  - The concepts of homogeneous and particular solutions.
  - Connection with the frequency domain solution.
  - Relation between the homogeneous/particular solution setting versus the zero-input/zero-state setting.
- (4 weeks) Special topics
  - Coupled inductors, transformers, the dot convention.
  - Brief introduction to MOSFETs. Digital/analog operation.
    Small signal characteristics. Circuits with MOSFETs.
  - Transmission lines.
- **Course outcomes**

Given a system (electrical/mechanical)	→	**write equations (algebraic/differential)**	→	**Solution (time/frequency)**	→	**Interpretation**